

STUDIES ON THE GENUS *FORCIPOMYIA*. V. KEY TO
SUBGENERA AND DESCRIPTION OF A NEW
SUBGENUS RELATED TO *EUPROJOANNISIA*
BRÈTHES (DIPTERA: CERATOPOGONIDAE)

Willis W. Wirth and Niphan Chanthawanich Ratanaworabhan

Abstract.—*Saliohelea*, new subgenus of the genus *Forcipomyia* Meigen, is proposed for *F. leei*, new species (type-species), from the Nearctic and Neotropical regions, *F. brevicosta* (Clastrier) from West Africa, *F. deminuta* Tokunaga and Murachi from the western Pacific, and *F. stami*, new species, from Zaire. A provisional key to the subgenera of *Forcipomyia* is presented. *Saliohelea* is most closely related to *Euprojoannisia* Brèthes and differs mainly in the complete fusion of the fourth and fifth palpal segments, the absence of mandibular teeth in the female, the characteristically sclerotized margins of the male aedeagus and the shape and arrangement of the spiracular openings on the pupal respiratory horn. It is also related to *Warmkea* Saunders, from which it differs in its shorter costa and distal antennal segments, the shape of the fourth palpal segment, the absence of mandibular teeth in the female and the arrangement of the spiracular openings on the pupal respiratory horn.

We have become especially interested in the classification of the small, inconspicuously brownish, hairy, biting midges of the genus *Forcipomyia* Meigen because of their importance in the pollination of cacao (*Theobroma cacao* L.) and other tropical crop plants (Saunders, 1956 and 1959; Dessart, 1961 and 1963; Barroga, 1964; Soria and Wirth, 1974; Kaufmann, 1975; Winder, 1977). There is a small group of species for which we have found characters of the female, male and pupa that in our opinion, justify the description of a new subgenus.

The modern classification of the genus *Forcipomyia* is well grounded in the recent works of Saunders (1956 and 1959), Tokunaga and Murachi (1959), Dessart (1963), and Chan and LeRoux (1965 and 1971). Readers are referred to these authors for explanation of our terminology and a fuller discussion of subgeneric classification.

We are especially indebted to Paul G. Bystrak, Maryland Department of Agriculture, Annapolis, for his excellent research on the taxonomy of all stages of the North American species of the subgenus *Euprojoannisia* Brèthes. His work has given us a much deeper insight into the taxonomy of this subgenus as well as those others most closely related to the new subgenus. Mr. Bystrak provisionally included our new species *F. leei* in

his unpublished thesis (Bystrak, 1974) and has permitted us to draw freely upon his description and discussion.

Tokunaga and Murachi (1959) gave a short diagnosis of what they termed "Subgenus C" for a provisional group containing only the species *Forcipomyia deminuta* Tokunaga and Murachi from Micronesia. They compared "Subgenus C" with the subgenera *Proforcipomyia* Saunders and *Synthyridomyia* Saunders. Dessart (1963) commented on Tokunaga and Murachi's "Subgenus C" and included it in his keys to the African subgenera of *Forcipomyia*; he assigned the African species *Lasiohelea brevicosta* Clastrier to this subgenus. We have found two additional undescribed species that fit in this group and with sufficiently distinct characters of the adult and pupa to prompt us to describe a new subgenus to contain them.

Forcipomyia, subgenus *Saliohelea* Wirth and Ratanaworabhan,
new subgenus

Fig. 1

Forcipomyia, subgenus C; Tokunaga and Murachi, 1959:219, Dessart, 1963:24.

Type-species.—*Forcipomyia (Saliohelea) leei* Wirth and Ratanaworabhan, new species.

Description.—Small, unmarked, yellowish to brownish species. Female antenna (Fig. 1b) with five distal segments not much longer than preceding segments, AR 0.78–1.20. Palpus (Fig. 1a) 4-segmented, primitive 4th and 5th segments fused without trace of articulation, characteristically tapering to slender tip; 3rd segment with or without sensory pit. Mandible teeth absent.

Body, wings and legs usually more or less clothed with elongate, slender, scalelike hairs with 1–3 stripes or striations. Costa (Fig. 1d) short, costal ratio 0.41 to 0.52 in female. Hind tibial comb (Fig. 1h) with 4–5 slender spines in distal series. Hind tarsal ratio varying from 1.7 to 2.7; hind basitarsus of male sometimes expanded dorsally. Empodium (Figs. 1g and 1j) well developed in both sexes; claws rather slender and curved.

Female with a single well-developed spermatheca (Fig. 1i), this usually tapering to slender neck, a minute rudimentary 2nd spermatheca usually present. Male genitalia (Figs. 1m and 1n) similar to those of *Euprojoannisia* or *Warmkea* Saunders. Ninth sternum more or less transverse distally, with long, slender, anterolateral projections; 9th tergum short and tapering to moderately separated, setose, apicolateral lobes. Basistyle moderately stout; dististyle long and slender, nearly straight, tapering to tip. Aedeagus somewhat variable in form, usually with triangular basal portion without well-developed basal arch or lateral arms, this portion usually with distinct

marginal sclerotization; slender distal median process usually present, rounded or peglike, in 1 species with a submedian pair of slender posterior processes. Parameres with basistylar apodemes forming a more or less V-shaped basal arch, with a distinct mesal connective which is usually platelike but may be narrow; a pair of submedian posterior sclerotized processes may be present (completely absent in 2 species, short and pointed in 1 species, long and curved in 1 species).

Pupa with slender respiratory horn (Fig. 1e) bearing 6 spiracular openings spaced loosely around the apical margin giving it a crinite appearance.

Etymology.—The name *Saliohelea* is an anagram of *Lasiohelea* Kieffer, another subgenus of *Forcipomyia*.

Discussion.—Species of *Saliohelea* are most closely related to the subgenus *Euprojoannisia* (synonyms *Proforcipomyia* and *Euforcipomyia* Malloch), which they resemble in their small, unmarked, yellowish-brown appearance; tarsal ratio greater than 1.0; curved, slender tarsal claws, rather short distal antennal segments; and reduction of the last two palpal segments. Species of *Euprojoannisia*, however, differ in having palpal segments four and five both present, although their articulation is lost and they are partially fused; mandibular teeth are usually present in the female; striated scales are lacking on the body; two spermathecae are usually present; the mesal connective of the male basistylar apodemes is usually slender and rarely are indistinct posterior processes present; and the pupal respiratory horn is usually short and swollen with the spiracles arranged in a tight circle or partial circle at the apex.

The subgenus *Warmkea* is also close to *Saliohelea*. The resemblance is especially close in the complete loss of the fifth palpal segment, the presence of only one spermatheca, the general features of the male parameres, and the shape of the pupal respiratory horn. However, in *Warmkea* the distal antennal segments are usually much elongated, female mandibular teeth are present, the costa is much longer, the male aedeagus has a distinct shieldlike shape with a well-developed basal arch and no lateral thickenings, and the spiracles are arranged in a tight row on the pupal respiratory horn.

Biological information is available only for *Forcipomyia* (*Saliohelea*) *leei*, new species. Saunders reared the species from a pupa taken under bark of a fallen tree in the forest in Brazil, and Williams reared it from rotting pods of cacao in Trinidad. Numerous collections of *F. leei* were made in rain forest locations.

The following provisional key to the subgenera of *Forcipomyia* is presented for the convenience of workers trying to identify adult *Forcipomyia* material. The table to the subgenera presented by Saunders (1956) and the key in Dessart (1963) are now incomplete because of the recent description of additional subgenera. There admittedly will be many

difficulties in using this key because some subgenera are most distinct in the male sex, others in the female. The subgeneric classification of *Forcipomyia* is based primarily on the relatively good characters of the immature stages, and identification of the adults probably will always be difficult.

Key to the Subgenera of *Forcipomyia*
(for adults, primarily females)

1. Female antenna with distal 6 segments elongated; empodium large and broad, adapted for clinging to wings of insects; TR 3.0 or more *Pterobosca* Macfie
- Female antenna with distal 5 segments, if any, elongated, rarely distal 6; empodium not greatly enlarged or modified; TR 0.4-3.2 2
2. Palpus 4-segmented, only 1 segment distal to the 3rd (which bears the sensory organ) 3
- Palpus 5-segmented (segments 4 and 5 incompletely fused and non-articulated in *Euprojoannisia*) 8
3. Female with 2 large functional spermathecae 4
- Female with one large functional spermatheca 6
4. Body with deep greenish or bluish subcutaneous pigmentation, especially in abdomen *Caloforcipomyia* Saunders (part)
- Body without greenish or bluish subcutaneous pigmentation 5
5. Female antenna with 5 distal segments greatly elongated, the proximal ones short and globular; TR 2.66-3.00 *Blantonina* Wirth and Dow
- Female antenna with distal segments not much longer than those in proximal series, all segments elongate tapering; TR about 2.0 *Metaforcipomyia* Saunders
- 6(4). Female antenna with 5 distal segments much longer than the short proximal segments; costa long, CR usually about 0.67; TR 1.3-1.75; female mandibular teeth well developed *Warmkea* Saunders
- Female antenna with distal segments not much longer than those in proximal series, all segments short ovoid to moderately long tapering; costa variable; TR variable; mandibular teeth not developed 7
7. Basitarsi short, TR about 1.0; costa short, CR less than 0.5 genus A near *Lepidohelea* Kieffer
- Basitarsi elongate, TR about 2.0; costa short or moderately long *Saliohelea*, new subgenus

- 8(2). Female antennal segments of proximal series much shorter than distal 5, compressed, usually transverse 9
- Female antennal segments of proximal series not much shorter than distal segments, usually not compressed 12
9. Costa extending to well beyond middle of wing; 2nd radial cell much longer than 1st, very narrow; 1 subspherical spermatheca present, this without neck; female sucking vertebrate blood
Lasiohelea Kieffer
- Costa usually ending at or near middle of wing; 2nd radial cell not unusually long and narrow; 2 spermathecae with distinct necks present; not known to suck vertebrate blood 10
10. Second and 3rd palpal segments stout, 3rd with scattered sensilla or shallow pit; mandible with proximal teeth very strong; male empodium present; male parameres U-shaped
Rhynchoforcipomyia Wirth and Dow
- Third palpal segment with definite, deep sensory pit; mandibular teeth small and more uniform; male empodium and parameres various 11
11. Females suck blood from insects; male empodium present; male parameres U-shaped; larvae breed in moss and wet wood
Trichohelea Goetghebuer
- Female feeding habits unknown; male empodium usually absent; male parameres H-shaped; larvae breed in plant leaf axils
Phytohelea Remm
- 12(8). Fourth and 5th palpal segments incompletely fused, immovable; small, unmarked, brownish midges; TR greater than 1.0
Euprojoannisia Brèthes
- Fourth and 5th palpal segments distinctly separated, articulated; size, color, and TR various 13
13. Palpus with 3rd segment broadly swollen to past middle, usually nearly to tip, with sensory pit deep, extending nearly to base of segment; slender, hyaline, peglike, sensory spines present on surface near sensory pore; TR usually less than 0.5; large species, females suck insect blood
Microhelea Kieffer
- Palpus various, 3rd segment rarely swollen past midlength and not bearing peglike sensory spines on surface near sensory pore; TR usually more than 0.5; size and habits various 14
14. Body usually with metallic jade green or deep blue subcutaneous pigmentation; antenna unusually elongate and slender; palpus slender; TR 1.36-2.32; wing and body often with ornate color pattern
Caloforcipomyia Saunders (part)

- Body without greenish or bluish subcutaneous pigmentation; antenna usually much shorter; palpus, TR and coloration various 15
- 15. Small grayish or brownish unmarked species; TR usually greater than 2.0; antenna short, proximal segments subspherical, gradually more elongated distally; 1 spermatheca present 16
- Larger species, often with conspicuous markings on body, legs or wings; TR usually about 1.0 (0.5-1.5); 2 well-developed spermathecae present 17
- 16. Male genitalia with club-shaped parameres extending caudad from basistylar apodemes *Synthrydomyia* Saunders
- Male genitalia without club-shaped parameres *Thyridomyia* Saunders
- 17. Body with conspicuous, numerous, flattened scales in addition to normal setae and hairs; male genitalia with parameres not joined or fused at bases, dististyle elongate, sinuate with distinct distal expansion *Lepidohelea* Kieffer
- Body usually without scales, or if present they are usually not broad; male genitalia with parameres joined or fused at bases, dististyle not expanded distally 18
- 18. Male genitalia with aedeagus V-shaped, bearing a pair of small, sharp processes at tip *Schizoforcipomyia* Chan and LeRoux
- Male genitalia with aedeagus shield-shaped, with low basal arch *Forcipomyia*, s. str.

Forcipomyia (*Saliohelea*) *lei* Wirth and Ratanaworabhan, new species

Fig. 1

Female.—Wing length 0.62 mm; breadth 0.26 mm.

Head: Brownish, palpus paler. Proboscis (Fig. 1f) short. Antenna (Fig. 1b) with lengths of flagellar segments in proportion of 17-15-15-16-17-17-17-19-25-23-22-20-28; antennal ratio 0.89; segment 11 unusually long and segments 12-14 becoming progressively shorter; segments 4-10 subspherical to slightly elongate, 5 distal segments distinctly tapering to slender distal portions; 15 with distinct terminal papilla. Palpus (Fig. 1a) 4-segmented; lengths of segments in proportion of 10-12-38-23; PR 2.2; 3rd segment ovoid with shallow, round, sensory pit; 4th segment markedly tapered to slender tip. Mandible without visible teeth.

Thorax: Dark brown, pleuron paler. Legs (Fig. 1k) variably brownish to pale yellowish; with sparse setae and 1-stripped slender scales; no broad scales; hind tibial comb as in Fig. 1h. Tarsi (Fig. 1l) unmodified; hind TR 2.7. Empodium (Fig. 1g) well developed; claws curved, moderately

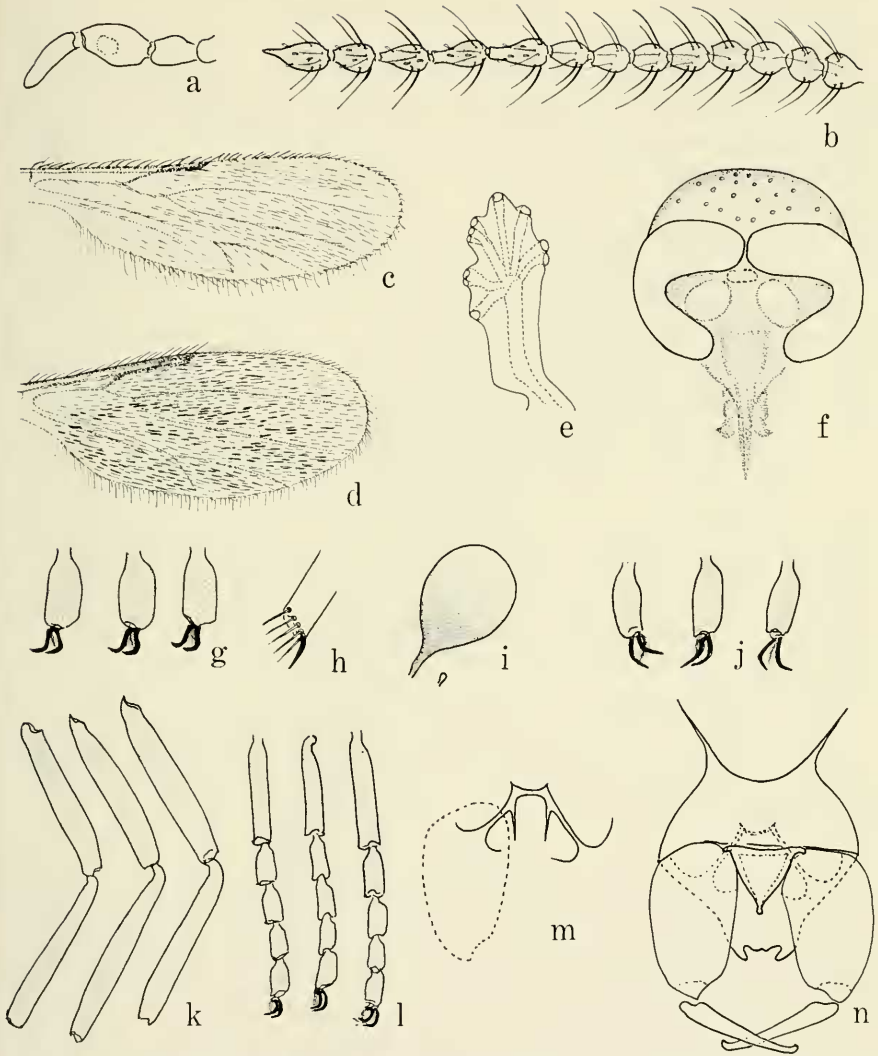


Fig. 1. *Forcipomyia (Saliohelea) leci*. a, female palpus; b, female antenna; c, male wing; d, female wing; e, pupal respiratory horn; f, female head; g, female fifth tarsomeres and claws of (left to right) front, middle and hind legs; h, hind tibial comb; i, spermatheca; j, male claws of (left to right) front, middle and hind legs; k, femora and tibia, of (left to right) hind, middle and front legs of female; l, tarsi of (left to right) hind, middle and front legs of female; m, male parameres; n, male genitalia, parameres removed.

stout. Wing (Fig. 1d) pale brownish due to moderately large microtrichia; macrotrichia especially long and coarse, decumbent, resembling slender, 1-striped scales; 1st radial cell obsolete, 2nd long and narrow; CR 0.52. Halter brownish.

Abdomen: Brownish, terga dark brown; last segment yellowish. Spermatheca as in Fig. 1h; one large ovoid functional spermatheca with long slender neck, usually with a minute irregularly tubular rudimentary spermatheca present; functional spermatheca measuring 0.052 by 0.030 mm including neck.

Male.—Wing length 0.64 mm; breadth 0.25 mm. Similar to female with usual sexual differences. Antenna with lengths of flagellar segments in proportion of 20-16-17-19-16-16-18-20-20-58-35-27-39; plume moderately long and dense, brownish; segments with 7-10 fused. Wing (Fig. 1c) with macrotrichia sparser than in female; CR 0.60. Hind TR 2.5; hind basitarsus slightly enlarged and darkened. Empodium moderately developed; claws (Fig. 1j) more slender than in female, without bifid tips.

Genitalia (Fig. 1n): Ninth sternum short with long anterolateral projections; 9th tergum short and tapering to moderately separated, setose, apicolateral lobes. Basistyle simple, about $2\times$ as long as broad; dististyle long and slender, nearly straight, tapering to slightly bent, pointed tip. Aedeagus triangular in ventral view, basal margin transverse or nearly so, with short anterolateral processes; proximal and lateral margins all with similar internal sclerotized thickening; apex with distinct slender terminal papilla. Parameres (Fig. 1m) with diagonal basal apodemes connected by a well-developed transverse connective, slightly arcuate, the concave side anterior; a short pair of slender, pointed processes projecting caudad from junction of apodeme and transverse connective, the length of these processes slightly variable, but usually less than length of aedeagus.

Pupa.—Length 1.7 mm. Color pale ochreous throughout. Head with a prominent tubercle at each anterolateral angle of antennal cases; a single low papilla and 2 pairs of minute spines on medium triangle; a small inconspicuous papilla on each lateral triangle. Thorax with 3 pairs of bulbous papillae on dorsum, and 1 minute pair at base of posterior prolongation, the latter extending across 1st abdominal segment. Prothoracic respiratory horn (Fig. 1e) very distinctive; with posterior basal shoulder similar to that of *Euprojoannisia*; distal portion enlarged, with 6 double or triple spiracular papillae arranged at intervals around margin giving a crinate appearance; tracheae of each papilla radiating from central felt chamber. Abdomen with many microchaetae on all surfaces of each segment; no large spines. Terminal abdominal processes long and slender, $1.5\times$ length of basal portion of 9th segment; male appendages dorsal, very short, each with a small lateral spine.

Distribution.—Eastern U.S.A., Neotropical Region to southern Brazil.

Types.—Holotype, ♀, Rio Raposo, Valle, Colombia, June–July 1963, V. H. Lee (Type no. 70440, USNM). Allotype, ♂, same data but July 1965, in light trap.

Paratypes, 43 ♂ and 35 ♀ as follows: COLOMBIA: Rio Raposo, Valle, Jan.–Dec. 1963–1965, V. H. Lee, light trap, 22 ♂, 18 ♀. Rio Anori, Antioquia, Sept. 1970, D. G. Young, light trap in rain forest, 2 ♂, 2 ♀. BRAZIL: Belem, Para, April 1970, T. H. G. Aitken, light trap, 1 ♂. Nova Teutonia, Santa Catarina, Sept. 1961, F. Plaumann, 1 ♀. Rio de Janeiro, 31 July 1923, L. G. Saunders, reared from beneath bark of fallen tree in forest, 1 ♂ and associated pupal exuviae. Rio Preto, Amazonas, 7 June 1962, E. J. Fittkau, at light, 1 ♂. TRINIDAD: No locality, Aug. 1963, R. W. Williams, reared from rotting cacao pods, 1 ♂, 4 ♀. DOMINICA: Cabrit Swamp, 23 Feb. 1965, W. W. Wirth, 1 ♀. Central Forest Reserve, 11 May 1968, P. C. Drummond, black light, 1 ♀. d'Leau Gommier, 17 March 1956, J. F. G. Clarke, 1 ♂. Fond Figues River, 11 Feb. 1965, W. W. Wirth, rain forest, 1 ♂. Pont Casse, April 1964, O. S. Flint, at light, 1 ♂, 1 ♀; same, 12 Feb. 1965, W. W. Wirth, rain forest, 2 ♀. PUERTO RICO: El Verde, Barrio Rio Grande, G. E. Drewery, sticky trap, 1 ♀. Mayaguez, Univ. Puerto Rico Campus, 13 Aug. 1969, T. Walker and P. Drummond, 1 ♀. JAMAICA: Hardwar Gap, 10 May 1970, W. W. Wirth and T. Farr, malaise trap, 3 ♂, 2 ♀. U.S.A.: FLORIDA: Alachua Co., Gainesville, June 1967, F. S. Blanton, light trap, 2 ♂, 1 ♀. Jefferson Co., Monticello, Oct. 1969, W. H. Whitcomb, light trap, 1 ♂. Leon Co., 3 mi N Tallahassee, May 1970, F. S. Blanton, light trap, 1 ♂. Marion Co., Juniper Springs, 28 Apr. 1970, W. W. Wirth, light trap, 1 ♂. Orange Co., Lake Magnolia Park, 6 Aug. 1970, E. Irons, light trap, 1 ♀. SOUTH CAROLINA: Georgetown Co., Hobcaw House, 20 Apr. 1972, Mrs. L. Henry, light trap, 2 ♂. VIRGINIA: Fairfax Co., Falls Church, Holmes Run, 7 Sept. 1961, W. W. Wirth, light trap, 1 ♂. NEW YORK: Newcomb, Lake Harris, 19 Aug. 1972, L. Knutson, malaise trap, 1 ♂.

Etymology.—This species is named for Vernon H. Lee in recognition of his extensive contributions to our knowledge of Colombian biting midges. Dr. Lee collected ceratopogonids extensively for us in Colombia as a member of a Rockefeller Foundation arbovirus research team.

Discussion.—*Forcipomyia leei* is closely related to the African species *F. stami*, new species, with differences as discussed under that species. *Forcipomyia leei* is a very widespread species, occurring from the northeastern United States to southern Brazil and, as might be expected, varies somewhat in leg color and in the length of the posterior processes of the male parameres. We have been unable to correlate this variation with geographical distribution or other factors and conclude that our material is conspecific.

Forcipomyia (Saliohelea) stami Wirth and Ratanaworabhan, new species
Fig. 2

Female.—Wing length 0.66 mm; breadth 0.34 mm.

Head: Brown, including palpi and antennae. Antenna (Fig. 2a) with lengths of flagellar segments in proportion of 20-14-15-15-15-16-17-20-26-27-27-24-34; antennal ratio 1.00; segments 4-10 progressively globular to short tapering, 11-14 moderately elongate, tapering. Palpus (Fig. 2d) with lengths of segments in proportion of 14-13-36-34; 3rd segment ovoid with large, round, shallow sensory pit; PR 1.9; 4th segment tapering to moderately slender tip. Mandible without visible teeth.

Thorax: Dark brown, pleuron slightly paler. Legs yellowish, distal tarsomeres slightly infuscated; hind tibial comb (Fig. 2c) with 5 subequal setae; hind TR 1.86; empodium well developed; claws slender and curved, pointed distally (Fig. 2f). Wing (Fig. 2b) pale brownish due to moderately large microtrichia; macrotrichia long and coarse, 1-striated, moderately dense, without color pattern; 1st radial cell obsolete, 2nd slitlike; costa exceptionally short, CR 0.41. Halter brownish.

Abdomen: Brownish including terminal segments and cerci. Spermathecae (Fig. 2e): 1 large ovoid functional spermatheca with long slender neck, measuring 0.058 by 0.032 mm; a tiny, ovoid, well-sclerotized, rudimentary spermatheca present.

Male.—Wing length 0.74 mm; breadth 0.25 mm; CR 0.44. Similar to female, with usual sexual differences. Hind TR 1.90.

Genitalia as in Fig. 2h: Ninth sternum moderately short, with distinct caudomedian excavation; 9th tergum tapering to rather closely approximated apicolateral lobes. Basistyle rather slender; dististyle straight to slender, slightly pointed tip. Aedeagus slightly longer than basal breadth; basal arch low; outline triangular in ventral view, the sides moderately sclerotized with a thinner, slightly concave, marginal rim; apex produced slightly in a slender terminal papilla. Parameres (Fig. 2g) with slender, diagonal basal apodemes joined mesally in a short, quadrate, transverse connective; no trace of submedian caudal processes from this platelike connective.

Distribution.—Zaire.

Types.—Holotype, ♀, allotype, ♂, Zaire, Coquilhatville, March-April 1972, A. B. Stam (Type no. 17305, USNM).

Paratypes, 2 ♂, 1 ♀, same data.

Etymology.—This species is named for its collector, Professor A. B. Stam, Director of the Institute of Entomology and Parasitology of Africa, Kumasi, Ghana, in recognition of his keen interest in the taxonomic study of African biting midges.

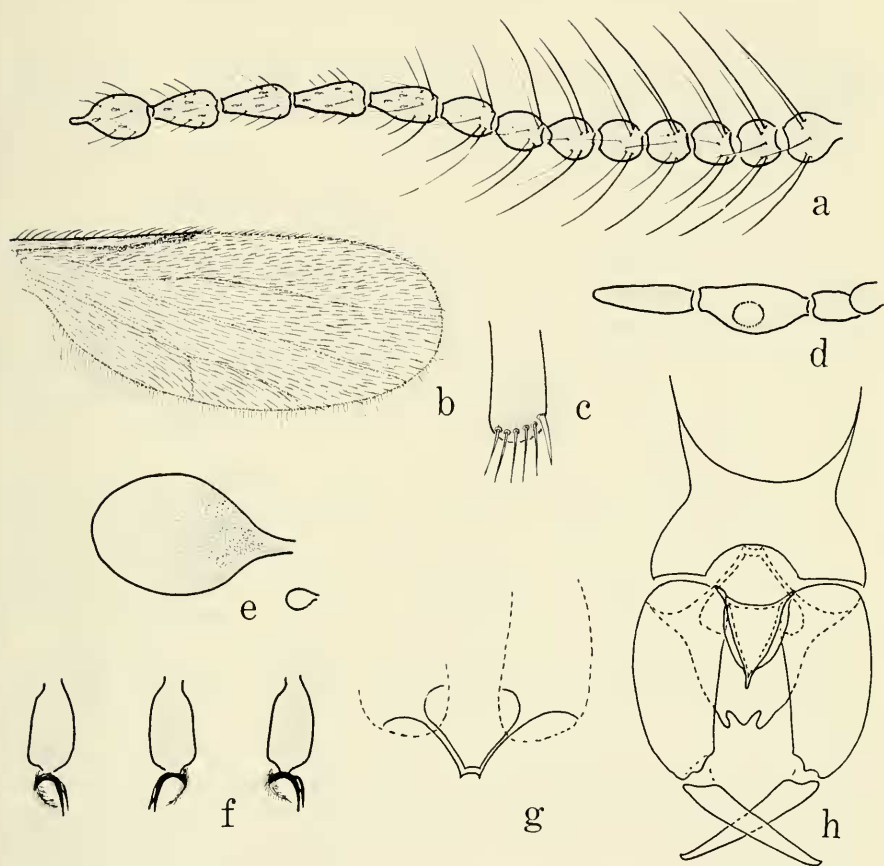


Fig. 2. *Forcipomyia (Saliohelea) stami*. a, female antenna; b, female wing; c, hind tibial comb; d, female palpus; e, spermatheca; f, fifth tarsomere and claws of (left to right) front, middle and hind legs of female; g, male parameres; h, male genitalia, parameres removed.

Discussion.—*Forcipomyia stami* is closely related to the American *F. leei*, appearing almost identical to some variants of *leei*, but differing as follows: In *stami* the costa is shorter, the distal antennal segments are longer, the hind basitarsus is shorter and the posterior processes are lacking in the male parameres. The latter character causes a problem with the subgeneric diagnosis, but occasional variation of the same character in the related subgenus *Euprojoannisia* shows the same instability and is not considered critical to subgeneric recognition.

Forcipomyia (Saliohelea) brevicosta (Clastrier)

Fig. 3

Lasiohelea brevicosta Clastrier, 1960:520 (♀; Congo; fig. wing, antenna, palpus).

Forcipomyia (subgenus C) *brevicosta* (Clastrier); Dessart, 1963:47 (re-described; compared with *deminuta* T. & M.; combination).

Female.—Wing length 0.83 mm; breadth 0.33 mm.

Head: Brown. Antenna (Fig. 3a) with lengths of flagellar segments in proportion of 25-20-20-20-20-21-23-25-37-37-40-40-53; AR 1.20; distal 5 segments distinctly more elongate than in *F. leei*, without the peculiar shortening of the subapical segments. Palpus (Fig. 3b) with lengths of segments in proportion of 10-15-36-34; 3rd segment without definite sensory pit; palpal ratio 2.1 (Clastrier's figure shows the 3rd palpal segment stouter, with palpal ratio 1.8).

Thorax: Dark brown. Legs uniformly yellowish brown; hind TR 1.83 (2.0 in holotype according to Clastrier), much lower than the TR of 2.7 found in *F. leei*; hind basitarsus not swollen. Tibial comb as in Fig. 3d, 5th tarsomeres and claws as in Fig. 3f. Wing (Fig. 3c) with CR 0.48; macrotrichia broader than in *F. leei*, more scalelike with up to 3 or 4 striations, compared with a maximum of 1 stripe in *F. leei*. Halter brown.

Abdomen: Uniformly brown. Spermatheca (Fig. 3e) ovoid to pyriform, tapering to duct; without the slender neck found in *F. leei*; measuring 0.058 by 0.033 mm; a minute, oval, rudimentary 2nd spermatheca present.

Male.—As in the female with the usual sexual differences. Genitalia (Fig. 3h) with 9th segment similar to those of *F. leei*. Basistyle moderately slender, slightly curved; dististyle slightly more slender and more curved than in *leei*. Aedeagus about as broad as long, basal arch low, basal arms stout and scarcely differentiated; distal portion cleft a short distance in a contiguous pair of short, curved, strongly sclerotized processes. Parameres (Fig. 3g) with long, slender, oblique basal apodemes, anterior connective short, bearing a posterior pair of long, curved, moderately stout, strongly sclerotized posterior processes, their apices slightly crossed on midline just distad of tip of aedeagus.

Distribution.—West Africa (Rep. Congo, Nigeria).

Type.—Holotype, ♀, Nuku N'Situ, Rep. Congo, May 1956, R. Taufflieb, (in Inst. Pasteur d'Algerie, Algiers).

Material examined.—NIGERIA: Redescribed from 5 ♂, 2 ♀, Ibadan, Aug. 1962, D. C. Eidt, malaise trap (through Canadian National Collection, Ottawa).

Discussion.—The present material agrees well with Clastrier's original description, except as noted above. The most important differences from

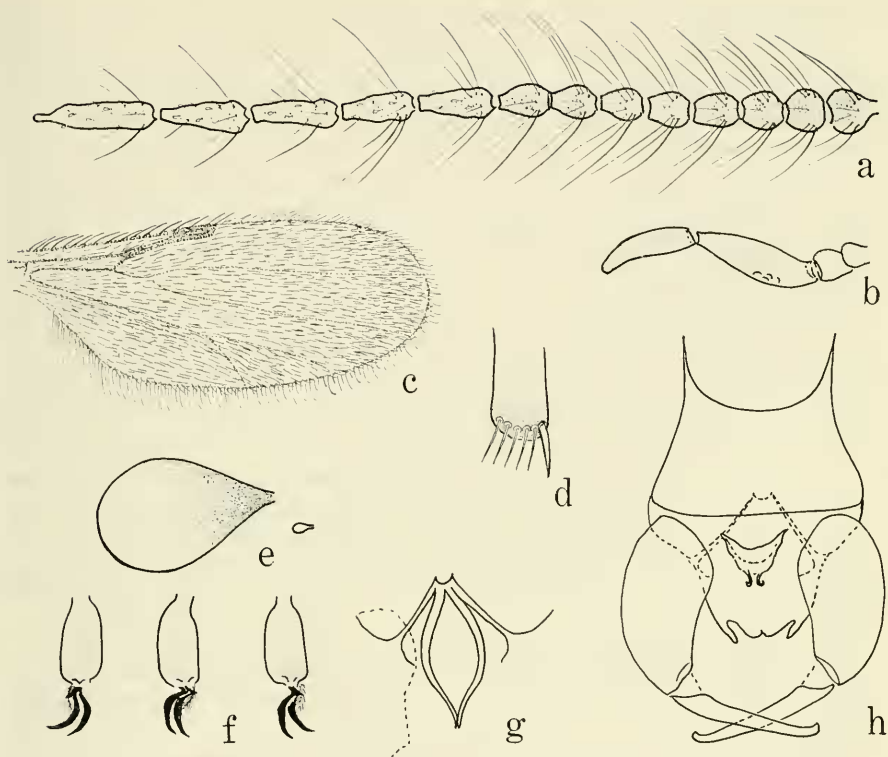


Fig. 3. *Forcipomyia (Saliohelea) brevicosta*. a, female antenna; b, female palpus; c, female wing; d, hind tibial comb; e, spermatheca; f, fifth tarsomere and claws of (left to right) front, middle and hind legs of female; g, male parameres; h, male genitalia, parameres removed.

F. leei, which while still permitting assignment to the subgenus *Saliohelea* require a slight adjustment in the subgeneric concept, are the more elongate distal antennal segments, the lack of a sensory pit on the third palpal segment, the more elongate, curved parameres and the distinctly cleft tip of the male aedeagus.

Forcipomyia (Saliohelea) deminuta Tokunaga and Murachi

Forcipomyia (subgenus C) *deminuta* Tokunaga and Murachi, 1959:219 (δ , η ; Palau and Caroline Islands; figs.).

Female.—Wing length 0.62 mm; breadth 0.25 mm. A tiny, uniformly pale yellowish-brown species without distinctive markings. Antenna with all flagellar segments short tapering, lengths in proportion of 10-8-8-8-8-9-9-

9-9-9-9-10-15; AR 0.78. Palpal segments with lengths in proportion of 4-10-24-19; PR 2.6; 3rd segment slightly swollen at base, slender distally, with an indistinct, small, shallow, round sensory pit at midlength; 4th segment quite slender, slightly narrowed on distal portion. Mandible without visible teeth. Legs with TR 2.2 on front leg, TR 1.71 on middle leg, and TR 1.67 on hind leg; tarsi with numerous 1-3 striped, slender, scalelike hairs. Wing with CR 0.48. Halter pale yellowish. Abdomen yellowish; spermatheca single, ovoid, tapering to slender neck (Tokunaga and Murachi's figure showing two spermathecae is apparently in error; it was stated to be single in their description).

Male.—Wing length 0.80 mm; breadth 0.24 mm. As in female with usual sexual differences; CR 0.47; TR 2.38 on front leg, 1.81 on middle leg, and 1.81 on hind leg; hind basitarsus distinctly swollen. Genitalia with aedeagus small and triangular without well-developed basal arch or lateral arms, the anterior and lateral margins with distinct narrow internal sclerotization (not shown in Tokunaga and Murachi's figure); median distal process slender, peglike. Parameres with diagonal basistylar apodemes, the sclerotization of the median connective indistinct and poorly visible (shown as quite extensive in Tokunaga and Murachi's figure); posterior processes not visible.

Distribution.—Micronesia, Philippines.

Types.—Holotype, ♂, allotype, ♀, Mt. Temwetemwensekir, Ponape, Caroline Islands, 180 m, 19 Jan. 1953, J. L. Gressitt (in Bishop Museum, Honolulu).

Material examined.—CAROLINE ISLANDS: 2 ♂, same data as types (in USNM). PHILIPPINE ISLANDS: 7 ♀, Mindanao, Mt. Apo, Davao Prov., 15 Nov. 1947, H. Hoogstraal and F. Werner (Chicago Nat. Hist. Mus. and USNM).

Discussion.—This species was well illustrated by Tokunaga and Murachi (1959). The Philippine material conforms closely to the original description of the female from Micronesia, and we add this new distribution without hesitation.

Acknowledgment

Acknowledgment is gratefully made by the junior author to the Southeast Asia Treaty Organization of Bangkok for financial assistance for study at the U.S. National Museum.

Literature Cited

- Barroga, S. F. 1964. Progress report on the study of insects, particularly midges associated with pollination of *Theobroma cacao*, April, 1963. Philipp. J. Plant Ind. 29:123-133.

- Bystrak, P. G. 1974. A revision of the Nearctic species of *Euforcipomyia* Malloch, a subgenus of *Forcipomyia* Meigen (Diptera: Ceratopogonidae). Unpublished M.S. Thesis, University of Maryland, College Park. August 1974. 121 pp.
- Chan, K. L. and E. J. LeRoux. 1965. Description of *Forcipomyia* (*Neoforcipomyia*) sp. n. and redescription of *Forcipomyia* (*Neoforcipomyia*) *equus* (Johannsen) (Diptera: Ceratopogonidae), with an account of the digestive and reproductive systems. *Phytoprotection* 46:74-104.
- . 1971. Phylogenetic relationships in the Forcipomyiinae (Diptera: Ceratopogonidae). *Can. Entomol.* 103:1323-1335.
- Clastrier, J. 1960. Notes sur les cératopogonidés XI.—Cératopogonidés de la République du Congo (3). *Arch. Institut Pasteur d'Algérie* 38:510-526.
- Dessart, P. 1961. Contribution a l'étude des Ceratopogonidae (Diptera). Les *Forcipomyia* pollinisateurs du cacaoyer. *Bull. Agric. Congo Belge* 52:525-540.
- . 1963. Contribution a l'étude des Ceratopogonidae (Diptera) (VII). Tableaux dichotomiques illustrés pour la détermination des *Forcipomyia* Africains. *Mem. Inst. R. Sci. Nat. Belge* (2 Ser.) 72:1-151.
- Kaufmann, T. 1975. Ecology and behavior of cocoa pollinating Ceratopogonidae in Ghana, W. Africa. *Environ. Entomol.* 4:347-351.
- Saunders, L. G. 1956. Revision of the genus *Forcipomyia* based on characters of all stages (Diptera, Ceratopogonidae). *Can. J. Zool.* 34:657-705.
- . 1959. Methods for studying *Forcipomyia* midges, with special reference to cacao-pollinating species (Diptera, Ceratopogonidae). *Can. J. Zool.* 37:33-51.
- Soria, S. de J. and W. W. Wirth. 1974. Identidade e caracterização taxonômica preliminar das mosquinhas *Forcipomyia* (Diptera, Certopogonidae) associadas com a polinização do cacaeiro na Bahia. *Rev. Theobroma* 4(1):3-12.
- Tokunaga, M. and E. K. Murachi. 1959. Insects of Micronesia. Diptera: Ceratopogonidae. B. P. Bishop Museum. *Insects Micronesia* 12:103-434.
- Winder, J. 1977. Field observations on Ceratopogonidae and other Diptera: Nematocera associated with cocoa flowers in Brazil. *Bull. Entomol. Res.* 67:57-63.

(WWW) Systematic Entomology Laboratory, IIBIII, Fed. Res., Sci. and Educ. Admin., USDA, c/o U.S. National Museum, Washington, D.C. 20560; and (NCR) Applied Scientific Research Corporation, Bangkok, Thailand.